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COMMENTARY

Post-fracture management of patients with hip fracture: a perspective*

O. Bruyere[a], M.-L. Brandi[b], N. Burlet[c], N. Harvey[d], G. Lyritis[e], H. Minne[f], S. Boonen[g], J.-Y. Reginster[h], R. Rizzoli[i] and K. Akesson[j]

[a]*Department of Public Health, Epidemiology & Health Economics, University of Liège, Liège, Belgium*

[b]*Department of Internal Medicine, University of Florence, Florence, Italy*

[c]*Science Manager, International Osteoporosis Foundation, Nyon, Switzerland*

[d]*MRC Epidemiology Resource Centre and University of Southampton, Southampton, UK*

[e]*LRMS, KAT Hospital, 14561 Kifissia, Greece*

[f]*Institute of Clinical Osteology, Gustav Pommer & Clinic 'Der Fürstenhof', Bad Pyrmont, Germany*

[g]*Division of Gerontology and Geriatrics & Center for Musculoskeletal Research, Leuven University Department of Experimental Medicine, Leuven, Belgium*

[h]*Bone and Cartilage Metabolism Unit, University of Liège, Liège, Belgium*

[i]*Department of Rehabilitation and Geriatrics, University Hospitals of Geneva, Geneva, Switzerland*

[j]*Department of Orthopedics, Malmö University Hospital, Lund University, Malmö, Sweden*

Address for correspondence: Olivier Bruyere, University of Liège, Department of Public Health, Epidemiology and Health Economics, CHU Sart-Tilman Bât B23, 4000 Liège, Belgium.
Tel.: +32 4 366 25 81; Fax: +32 4 366 28 12; Olivier.Bruyere@ulg.ac.be

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ABSTRACT

Background: Hip fracture creates a worldwide morbidity, mortality and economic burden. After surgery, many patients experience long-term disability or die as a consequence of the fracture. A fracture is a major risk factor for a subsequent fracture, which may occur within a short interval.

Methods: A literature search on post-fracture management of patients with hip fracture was performed on the Medline database. Key experts convened to develop a consensus document.

Findings: Management of hip-fracture patients to optimize outcome after hospital discharge requires several stages of care co-ordinated by a multidisciplinary team from before admission through to discharge. Further studies that specifically assess prevention and post-fracture management of hip fracture are needed, as only one study to date has assessed an osteoporosis medication in patients with a recent hip fracture. Proper nutrition is vital to assist bone repair and prevent further falls, particularly in malnourished patients. Vitamin D, calcium and protein supplementation is associated with an increase in hip BMD and reduction in falls. Rehabilitation is essential to improve functional disabilities and survival rates. Fall prevention and functional recovery strategies should include patient education and training to improve balance and increase muscle strength and mobility. Appropriate management can prevent further fractures and it is critical that high-risk patients are identified and treated. To foster this process, clinical pathways have been established to support orthopaedic surgeons.

Conclusion: Although hip fracture is generally associated with poor outcomes, appropriate management can ensure optimal recovery and survival, and should be prioritized after a hip fracture to avoid deterioration of health and prevent subsequent fracture.

*This article is based on the outcomes of a Working Group meeting convened 18 April 2008, by the European Society on Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO), in Cannes, France. The Working Group was co-ordinated by Prof. Steven Boonen

Introduction

Hip fractures are associated with the highest degree of morbidity and mortality of all fractures, particularly in elderly patients. Hip fracture patients usually require hospitalization and surgery. After surgery, patients need support through the rehabilitation and recovery process. However, many do not receive optimal care and experience long-term disability, with 27% of patients entering a nursing home for the first time within 1 year of the hip fracture[1]. Furthermore, many patients never regain their independence, and either suffer from a major disability or die as a consequence of the hip fracture[2], and a fracture is a major risk fracture for subsequent fracture[3–5]. As a consequence, more effective strategies are needed to reduce the burden on healthcare providers and improve patient quality of life and outcomes after hip fracture.

On 18 April 2008, a Working Group meeting was convened in Cannes, France, by the European Society on Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO). The meeting focused on developing a consensus for the optimal management of patients hospitalized for hip fracture, and a summary of the outcomes of the meeting are presented in this paper.

Methods

In order to review the topics addressed in this article, a literature search was performed on the Medline database. English-language articles from 1980 to April 2008 were included. Search terms used were: hip fracture, epidemiology, prevention, treatment, rehabilitation, gene, operative care, nutrition, and fall. Manual searches in the abstract books of two recent osteoporosis meetings were also performed: American College of Rheumatology Annual Scientific Meeting (November 2007) and the European Congress on Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (April 2008). A limitation to this review was that the Medline database was the only online source used to perform the literature search.

Key experts from various areas (epidemiology, genetics, geriatric medicine, endocrinology, rheumatology, orthopaedic surgery and rehabilitation) were identified and invited to a consensus meeting of experts (funded by ESCEO) to develop the current consensus document.

Discussion

Epidemiology and burden of hip fracture

Major advancements in treatments for osteoporosis have occurred in the last two decades with the introduction of bisphosphonates, selective oestrogen receptor modulators (SERMs), parathyroid hormone (PTH) and strontium ranelate. Despite these advances, osteoporosis has a major impact on health. In 2000, the cost of treating hip, spine and wrist fractures in Europe was 32 billion euros, with hip fractures accounting for 890 000 (23%) cases of fractures[6]. Hip fracture rates are predicted to continue rising in the developed world because of the ageing population; increasing age-adjusted incidence of hip fracture in combination with higher numbers of elderly people will lead to the greatest increases occurring in developing countries[7]. The mortality rate in patients who experience a hip fracture is 15–25%, with the majority of patients dying in the first year after fracture, usually due to comorbidities[5,8–10]. Furthermore, hip fractures have a lasting impact on quality of life[11]; for example, patients are likely to be admitted to a nursing home and require walking aids. They are also at a high risk of further fractures[8]. Prospective controlled data have provided evidence that women who sustain a hip fracture continue to suffer from substantial functional impairment and loss of quality of life at 1 year despite significant recovery[12]. Function on discharge is the strongest predictor of functional status 1 year later[12], supporting the need to optimise in-hospital management of these patients.

The lifetime risk of a hip fracture is 14% in European women, and 3% in men, with incidence increasing exponentially with age[13]. At younger ages men have a higher incidence of fractures than women, but after the age of 50 years fracture risk in women overtakes that of men[14]. There is also a large variation in probability of hip fractures in different regions of the world, with countries such as Sweden, Norway and Iceland showing the highest probabilities, and France and Spain showing lower probabilities[15].

There is some evidence that social conditions affect the risk of hip fractures. A case–control study conducted in Denmark found that hip fracture risk was lower in people who were living with someone, had a higher level of education and were under 60 years of age, or were employed[16]. Alcoholism was a predictor of increased risk of hip fracture in all age groups. Other studies have shown that many factors related to psychological insufficiency and mental health are associated with increased risk, particularly in men[17], and

that risk of first hip fracture is higher and occurs at an earlier age in low income communities[18].

In order to more comprehensively identify those who should be treated to prevent future fractures, the World Health Organization has developed an algorithm for risk stratification for use in the primary care setting (Figure 1), based on 12 international cohorts totalling 250 000 patient-years[19,20]. The contribution of risk factors (such as age, prior fragility fracture, parental history of hip fracture) to 10-year absolute fracture risk is used to determine whether patients have a fracture probability greater than the treatment threshold.

Genetic influence on the risk of hip fracture

The study of genetic factors underlying osteoporosis is a developing area, and the impact of genes on osteoporosis remains unclear. Many studies investigating the genetic basis of bone strength have focused on bone mineral density (BMD). However some studies have investigated the association of genetics with fracture, particularly vertebral fractures, but often studies are not powered for the low rate of hip fractures reported.

Twin studies have provided data on genetic factors related to hip fracture. One study investigated the influence of factors on hip axis length, a parameter that has been shown to predict hip fracture in white women[21]. The study found that approximately 10% of the increased risk of hip fracture associated with a maternal history of hip fracture could be attributed to genetic factors that determined hip axis length[22]. Another twin study involving a cohort of 30 000 Swedish twins born between 1896 and 1944 concluded that incidence of all fractures, but especially first hip fractures, at younger ages (before age 69 and 69–79 years) seemed to be strongly genetically influenced[23].

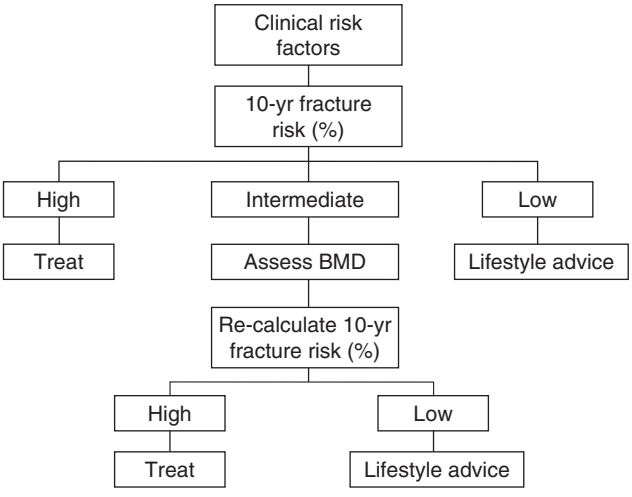


Figure 1. *WHO case-finding strategy for patients at risk of fracture*[19]

Studies in rats and mice have also suggested a genetic component to hip structure and strength. A study in two inbred rat strains showed that phenotypic variation at the femoral neck appeared to be associated with biomechanical properties. The authors concluded that the data suggested the existence of a substantial genetic component underlying hip fragility[24]. Another study in mice has shown that femoral size and shape correlates with different genetic markers[25].

Genes are important determinants of variation between different races and may contribute to differences in fracture rates. A lower rate of hip fractures has been reported in black men compared with white men[26]. This may be related to a 20% higher femoral neck bone mass in black men compared with white men, which is independent of lifestyle factors[27]. The rate of hip fracture in China is lower than in Western countries[28]. One study suggests that the short hip axis length and neck length in the Chinese population could independently contribute to their low hip fracture rate[29].

Several polymorphisms have shown an association with bone strength or fracture risk. For instance, the different vitamin D receptor alleles are associated with varying femoral neck BMD responses to vitamin D treatment[30]. In addition, the Collagen Type Iα1 (COLIA1) 's' allele may be linked to ethnic differences in hip fracture rate[31], and the apolipoprotein E*4 allele appears to be associated with high hip and wrist fracture risk in women[32]. Such alleles could be used as markers to assess fracture risk. In addition, an ongoing genome-wide mapping programme in China has found four genomic regions on four different chromosomes that may harbour quantitative trait loci influencing femoral neck cross-sectional geometry. The programme is also expected to generate further results[33].

It is clear that genetic components, as well as the environment, impact on risk of hip fracture, especially in early hip fracture. Further studies are needed in this area to evaluate the relative contribution at different ages and in populations of different ethnic background.

Peri- and postoperative care in hip-fracture patients

Management of patients with hip fractures should optimize outcome after discharge from hospital. This involves several stages of care (Table 1), beginning before the patient is admitted to hospital. It is vital that specific goals are set at each stage.

The main goal of prehospital care is to diminish pain and discomfort for the patient at the place of injury and during transportation. On admittance to the emergency room or ambulance, diagnosis and assessment – including medical history – should be carried out rapidly to diminish the risk of deterioration of health due to the fracture. Care, including pain management, oxygen, intravenous fluids and prophylaxis for pressure ulcers to improve status for surgery, should be administered, and comorbidities optimized. Many patients with hip fractures are poorly nourished and require specific attention, as will be discussed later in this article.

After diagnosis, the patient should be prepared for surgery, with the expectation that surgery will be performed within 24 hours. Care and pre-operative management (cushioning and temporary stabilisation of the fractured limb, monitoring of fluids, body temperature, oxygen saturation and pain) should be continued to ensure that the patient is comfortable, but pre-operative management also aims to limit postoperative complications. Surgical management involves choosing the optimal treatment method and performing high quality fracture surgery in a timely manner to enable restoration of function and minimize pain. The surgical methods vary depending on the type of hip fracture; trochanteric fractures are commonly stabilized with plates and screws or intra-medullary nails depending on fracture fragmentation, while arthroplasty is an additional and often preferable option for femoral neck fractures. During surgery, different aspects of anaesthesia should be considered to optimize patient outcome. This involves choosing a strategy aiming to minimize the possibility of negative cerebral and cardiovascular effects, with spinal anaesthesia most commonly employed. Care should also be taken to avoid pressure ulcers. Appropriate surgical technique should be employed to minimize tissue damage, blood loss and operating time.

Post-surgery care until discharge from the acute care unit should ensure maximum wellbeing of the patient to avoid complications such as infections.

Table 1. *Stages of care post-hip fracture required to optimize outcome after discharge from hospital*

Hip fracture – care components
• Pre-hospital
• Emergency room – pre-diagnosis
• Pre-operative management
• Surgical management
• In-hospital postoperative care
• Rehabilitation

This generally requires a multidisciplinary team of nurses, physio- and occupational therapists apart from orthopaedic surgeons, physicians specialized in elder care. Pain management should be continued, as should nutritional supplements. It is also important that steps are taken to ensure that the patients regain mobility as early as possible. This should include treatment of anaemia, which has been associated with decreased mobility following surgery[34].

Planning to prepare patients for discharge should start as soon as they are admitted to hospital. Pain medications must be tailored to the individual's needs and discontinued at an appropriate time, otherwise patients may experience dizziness and become more likely to fall again. It is essential that multidisciplinary teams are co-ordinated so that care after surgery is continuous and patient outcome is optimized. Fracture liaison services or clinical care pathways are essential in this respect, in order to diminish fall risk and to initiate pharmacological treatment for osteoporosis.

Treatment of postmenopausal osteoporosis: effect on hip fractures

Many osteoporosis treatments are currently available to reduce the risk of fractures, including agents that inhibit bone resorption (bisphosphonates, hormone replacement therapy [HRT], SERMs, calcium with vitamin D) or stimulate bone formation (PTH) and agents with complex mechanisms (D-hormones and strontium ranelate). Most fracture studies on osteoporosis treatments have been designed to assess improvements in vertebral fractures; however, some data on hip fracture risk are available. This section summarizes hip fracture data from bisphosphonate and strontium ranelate trials in postmenopausal women with osteoporosis.

The Fracture Intervention Trial (FIT 1) assessed the effects of alendronate (5 mg/day increased to 10 mg/day at 24 months) in postmenopausal women with prevalent vertebral fractures[35]. Results at 36 months showed there was a reduction in radiological hip fracture for patients receiving alendronate versus placebo (relative hazard ratio 0.49 [95% confidence interval [CI]: 0.233–0.99]); however, this showed borderline significance.

The effect of risedronate on risk of hip fracture in elderly women (> 70 years) was assessed in the Hip Intervention Program (HIP)[36]. In Group 1, patients were 70–79 years old with confirmed osteoporosis. Group 2 patients were at least 80 years old, with clinical risk factors (mainly non-skeletal) for hip fracture. The osteoporosis status was unknown for the majority of these patients. Risedronate reduced the overall risk of hip fracture versus placebo at 36 months in Group 1

(relative risk [RR] 0.6 [95% CI: 0.4–0.9], $p = 0.009$), but not Group 2. However the effect in Group 1 was totally driven by the risk reduction in a subset of patients who were 70–79 years with prevalent vertebral fractures, which accounted for only 18% of patients in the overall group, supporting the concept that bisphosphonate treatment in old age should be targeted to patients with documented osteoporosis. The RisedronatE and ALendronate cohort study (REAL) evaluated the onset of fracture reduction in clinical medical practice by measuring the incidence of hip and non-vertebral fractures among women > 65 years over the first 12 months of treatment[37]. Risedronate reduced the risk of hip fracture by 43% (95% CI 13–63%; $p = 0.01$) relative to alendronate at 12 months (adjusted for baseline risk factors).

In 64 182 patients, the antifracture effects of monthly ibandronate ($n = 7345$) versus weekly bisphosphonates (alendronate or risedronate) ($n = 56\,837$) over 12 months was investigated in the eValuation of IBandronate Efficacy (VIBE) study[38], using data from US-based longitudinal medical and pharmaceutical claims databases. Patients were observed for fractures occurring more than 90 days after treatment initiation while remaining on therapy. The primary analysis showed no difference in relative risk of hip or non-vertebral fractures for ibandronate (RR 0.88; $p = 0.26$) versus any comparison with weekly bisphosphonates (alendronate or risedronate) (RR 1.06; $p = 0.84$).

The HORIZON Pivotal Fracture Trial investigated the effect of once-yearly infusion of zoledronic acid 5 mg on fracture reduction in postmenopausal women with osteoporosis. Primary endpoints were new morphometric vertebral fractures in Stratum I (patients not receiving concomitant osteoporosis therapies) and first hip fracture in Strata I and II (all patients including those receiving concomitant osteoporosis therapies). At 36 months there was a 41% reduction in risk of hip fracture (RR 0.59 [95% CI: 0.42–0.83]; $p = 0.002$) with zoledronic acid versus placebo[39].

The antifracture effects of strontium ranelate have been investigated in TReatment Of Peripheral OSteoporosis (TROPOS) trial[40]. Although strontium ranelate did not reduce hip fracture risk in the overall population versus placebo, hip fractures were reduced by 36% (RR 0.64 [95% CI: 0.41–0.98]; $p = 0.046$) at 36 months in a subset of patients with a high risk of hip fracture (≥ 74 years, with femoral neck BMD ≤ –3 SD)[41]. The reduction in risk was maintained at 5 years in the high-risk population (RRR 43%; $p = 0.036$)[42].

In summary, there is evidence that alendronate, risedronate and zoledronic acid reduce the risk of hip fracture in women with established osteoporosis, and for strontium ranelate in a subset of patients at high risk of hip fracture. Zoledronic acid is the only bisphosphonate that has been shown to reduce risk of hip fracture in postmenopausal women without prevalent vertebral fractures.

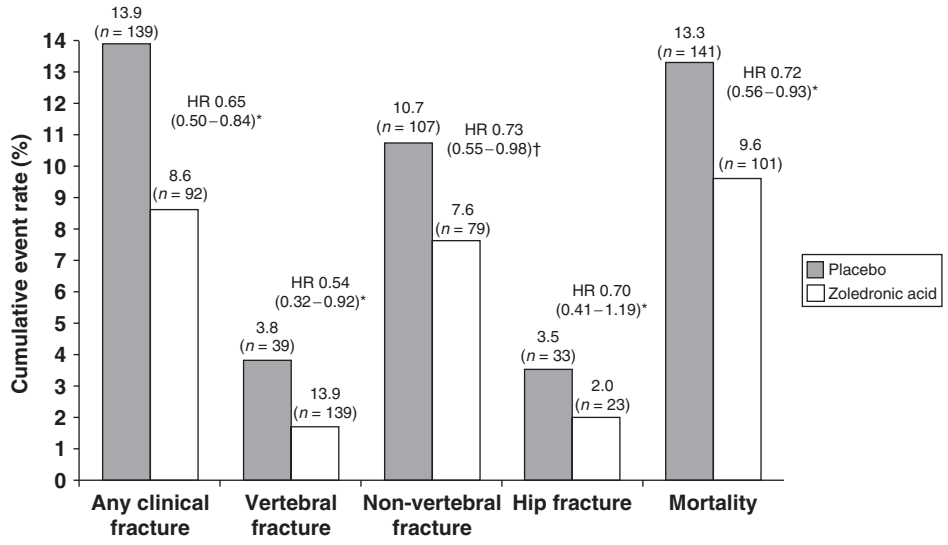
Pharmaceutical management of osteoporosis post-hip fracture

In patients with a prior hip fracture, the risk of a new osteoporotic fracture is 2.5-fold higher than in age-matched people without a previous hip fracture[43]. The increased fracture risk is associated with increased morbidity and the cost of managing hip fracture patients. Despite this, few patients receive evaluation and treatment for osteoporosis following a hip fracture[44–46]. Furthermore, few data are available to guide treatment following hip fracture, and this is partly due to the fact that hip-fracture patients are frail, elderly individuals and constitute a challenge in terms of trial design[47]. Only one study to date, the HORIZON Recurrent Fracture Trial, has assessed the efficacy and safety of an osteoporosis treatment, zoledronic acid, in men and women who had undergone recent surgical repair of a hip fracture[48]. This section gives an overview of this unique study[48].

The HORIZON Recurrent Fracture Trial was a 3-year, event-driven, randomized, double-blind, placebo-controlled trial in 2127 men and women, from 148 clinical centres in 23 countries. Participants were aged 50 years or older and were ambulatory prior to hip fracture. They were randomized to an annual infusion of either zoledronic acid 5 mg or placebo, plus a loading dose of vitamin D (50 000–125 000 IU), then calcium 1000–1500 mg/day plus vitamin D 800–1200 IU/day up to 90 days after surgery. The primary objective was to reduce the rate of new clinical fractures after a surgical procedure for a low-trauma hip fracture. Secondary objectives included reduction of clinical vertebral, non-vertebral and hip fracture risk[48].

Zoledronic acid 5 mg significantly reduced the cumulative risk of all clinical fractures, clinical vertebral fractures and clinical non-vertebral fracture over 3 years by 35%, 46% and 27%, respectively (Figure 2). Risk of hip fracture was reduced by 30%; however, this was not significant due to the low number of events[48].

Furthermore, this is the first study to show a reduction in mortality with an osteoporosis therapy after a hip fracture. All-cause mortality was reduced by 28% over 3 years (Figure 2) in the zoledronic acid group versus the placebo group[48]. The study investigators speculated that this may have been related in part to a reduction in new fractures after the initial hip fracture; however, further investigation is needed to



*$p < 0.05$; †$p = 0.18$; HR, hazard ratio

Event rates were calculated by Kaplan-Meier methods at 24 months and therefore are not simple percentages

Figure 2. *Rate of clinical fractures and mortality in the HORIZON-RFT study groups*[48]

understand more fully the reason for the reduction in the risk of death, which is probably multifactorial[48].

Zoledronic acid 5 mg was generally well-tolerated, with comparable incidences of adverse events (82.3% zoledronic acid vs. 80.6% placebo) and serious adverse events (38.3% zoledronic acid vs. 41.2% placebo). Fewer patients reported atrial fibrillation as a serious adverse event with zoledronic acid ($n = 12$, 1.1%) compared with placebo ($n = 14$, 1.3%; $p = 0.84$). No long-term effects were observed on renal function, and only a few cases of hypocalcaemia and no cases of osteonecrosis of the jaw were observed[48].

Nutritional aspects in the management of hip fracture

Undernutrition is common in elderly people, particularly those who are hospitalized or in nursing homes. It is also a problem in hip fracture patients, many of whom require hospitalization and admission to a nursing home[49–51].

Proper nutrition is essential in hip fracture patients to assist bone repair and prevent further falls. Both vitamin D deficiency and protein deficiency can impact on falls and bone mass. Severe vitamin D deficiency (serum levels < 30 nmol/L) is common in hip fracture patients[52]. Neuromuscular function is sensitive to vitamin D levels and patients with lower vitamin D levels have slower walking times and take longer to stand up[53]. After hip fracture, patients with higher serum vitamin D levels (> 22 nmol/L) have a better outcome in terms of lower extremity function and are less likely to fall[54]. Vitamin D supplementation (to serum levels > 60 nmol/L) in hip fracture patients is associated with a reduction in falls and an increase in hip BMD[55,56]. Therefore, vitamin D is important in the outcome – and possibly the recurrence – of hip fracture. To achieve adequate calcium balance and prevent bone loss and falls, elderly patients will benefit most from a combination of 800 IU of vitamin D with 1000–1200 mg of calcium daily[57,58].

In people with a low protein intake, insulin-like growth factor-1 (IGF-1) levels are reduced, which leads to a reduction in bone and muscle mass, thereby increasing the risk of fracture and falling[59]. The effect of protein supplements on rehabilitation after hip fracture risk has been investigated in several studies. In one study, patients were given a protein supplement (20 g/day), plus a vitamin D injection (200 000 IU) and calcium (500 mg/day) 10 days after fracture, or isocaloric placebo[60]. In patients receiving the protein supplement, serum IGF-1 levels increased at the 6-month follow-up relative to placebo. In another study, IGF-1 levels increased within the first 7 days of receiving the protein supplement and then plateaued, suggesting that early protein supplementation is beneficial but that it does not need to be maintained in the long term[61]. Other studies have shown that protein supplements have a beneficial effect on proximal femur BMD and vertebral fracture rate[60], a favourable clinical course[62] and length of stay in rehabilitation hospital[60].

Evidence shows that identifying malnourished patients with hip fracture and providing appropriate nutritional supplementation 10 days after fracture to optimize rehabilitation is important[60,61].

Malnourished patients can be identified by measuring skin-fold thickness or by a deficit in albumin levels.

Rehabilitation after hip fracture

The majority of hip fracture patients are elderly and require intensive treatment during rehabilitation to improve survival rates and functional disabilities. Mortality and functional disabilities in hip fracture patients have been shown to be influenced by several factors including poor mental status, limited functional ability prior to the fracture, institutional disposition at discharge, being over 80 years and gender[63]. Pain is strongly associated with a decrease in both instrumental and social functioning due to depression and physical ability; pain control may enhance functional status after hip fracture[64].

Prevention of falls

Falls are one of the most common geriatric problems threatening the independence of older people. Falls increase the risk of fracture by ten-fold in people with osteopoenia or osteoporosis[65]. Fear of falling is one of the most important factors influencing functional recovery after hip surgery in older people[66]; 16% of people with a tendency to fall limit their activity because of fear of falling and 30% reduce their participation in social activities[67,68]. However, at present there is relatively little hard evidence that strategies to reduce the risk of falling have an influence on the subsequent fracture risk. Most current recommendations are based on expert opinion rather than randomized controlled trials. As this is such an important issue, clinical studies on fall prevention are discussed. Several interventions have been studied but it is unclear which are the most effective or cost-effective strategies. The best approach to preventing falls is likely to use both the multifactorial falls risk assessment combined with supervised exercise programs. Fall prevention rehabilitation programs have the potential to be highly cost-effective and beneficial in elderly people with hip fracture.

Fall prevention strategies should involve education of high-risk groups and patients who have already sustained a fracture, to lower the risk of a fall. History of falls in the past year and a test for gait and balance disorders should be taken when patients are admitted for hip fracture. Risk of falling within 6 months of hip fracture surgery can easily be assessed by the timed 'up and go' (TUG) test[69], which includes tasks that are important for mobility, such as standing up and sitting down, walking, turning and stopping. There are many modifiable risk factors for falls (Table 2), and interventions can be focused on reducing multiple risk factors simultaneously[70]. Balance is the most important factor to improve. Strategies to maintain or increase muscle strength should also be employed.

Some evidence supports recommendations for exercise and training to reduce the risk of falling; however, the optimal type, duration and intensity remain unclear. A randomized prospective study in women with a mean age of 80 years demonstrated that after 1 year of lower-limb strength and balance training, mean number of falls was reduced by 35% compared with controls[71]. The FaME (Falls Management Exercise) randomized clinical trial in women over 65 years with a history of frequent falls found that in women who undertook the 9-month FaME exercise programme, risk of falling was decreased by 47% compared with the control group[72]. Vitamin D supplements improve body sway in elderly patients[73] and have been shown to reduce the risk of falls in community-dwelling men and women, at least at daily doses of 800 IU[74–76].

Patients in nursing homes may often receive less attention than community-dwelling patients, as their level of care is dependent on the staff knowing about fractures, falls and osteoporosis prevention. It is important to provide interventions to improve patient wellbeing and this involves continuous education of staff involved in care of elders. Group exercise, in combination with other interventions such as medication reviews and environmental modifications, can reduce the risk of falls and improve mobility in these patients[77,78]. Whole body vibration in nursing home residents has also been shown to be effective at improving fall risk factors (gait, balance, TUG test)[79].

Functional recovery

Several studies have assessed the effect of interventions on rehabilitation. The effectiveness of early multidisciplinary geriatric intervention in elderly patients hospitalized with hip fracture was evaluated in a randomized, controlled trial. In the geriatric intervention group, in-hospital mortality and medical complications

Table 2. *Modifiable risk factors for falls*

Modifiable risk factors for falls	
• Accident/environmental hazards	• Dizziness/vertigo
• Medications	• Syncope
• Mobility limitation	• Hypotension
• Low activity level	• Confusion
• Weakness	• Depression
• Gait deficits	• Hearing problems
• Balance deficits	• Urinary incontinence

were reduced and more patients achieved a partial recovery at 3 months compared with usual care (57% versus 44%, $p = 0.03$)[80]. A study in 20 older adults (81 ± 7 years) with hip fracture assessed the effect of an upper-body exercise programme five times a week on cardiorespiratory fitness during inpatient rehabilitation[81]. At discharge, the training group had better mobility and balance compared with the control group. Guidelines recommend early mobilization (first walk postoperative day 1 or 2) after hip surgery, although this is resource intensive. One study found that early ambulation after hip fracture surgery accelerated functional recovery and was associated with more discharges directly to home and less to high-level care compared with delayed ambulation[82]. However, a recent Cochrane review concluded there is insufficient evidence from randomized trials to establish the effectiveness of the various mobilization strategies used in rehabilitation after hip fracture surgery, and that further research is required to establish the possible benefits of additional interventions[83].

Clinical pathways in hip fracture

A prevalent fracture is a major risk factor for another fracture: women with pre-existing fractures have at least twice the risk of subsequent fractures (hip, spine, wrist, or any site) than those without prior fractures, and risk increases with number of prior fractures[3]. As risk of fractures can be reduced with appropriate management, it is critical that high-risk patients are recognized and treated. However relatively few older women with vertebral or hip fractures are identified or treated by clinicians[84,85].

To improve medical management of patients following acute management of the fracture, clinical pathways have been developed to support orthopaedic surgeons. One such pathway is the osteoporosis clinical pathway (OCP) established in Geneva (Figure 3)[86]. The pathway includes advising primary care physicians/orthopaedic surgeons of diagnostic and therapeutic approaches via interaction with the OCP multidisciplinary team, promoting appropriate use of diagnostic tools and therapeutic approaches without compromising the quality of care, and educating patients and their relatives about the management of their disease (physical therapy, lifestyle habits and nutrition). Fracture patients enrolled in the pathway were screened by dual-energy X-ray absorptiometry; 86% had low BMD or osteoporosis. Anti-osteoporotic therapy with calcium/vitamin D supplements was recommended for 33% of patients. Follow-up of patients at 6 months suggested that 63% of recommended treatments had been prescribed. In addition, the educational programme had a beneficial effect on compliance in patients with osteoporosis and on knowledge about osteoporosis in all patients[86].

The Glasgow Fracture Liaison Service in Scotland is another established pathway with a similar concept to the OCP, which has been used to model other services in the UK and abroad[87]. Its objectives are to identify patients at increased risk of osteoporotic fracture, to offer them appropriate information on osteoporosis and its management, and to provide advice to general

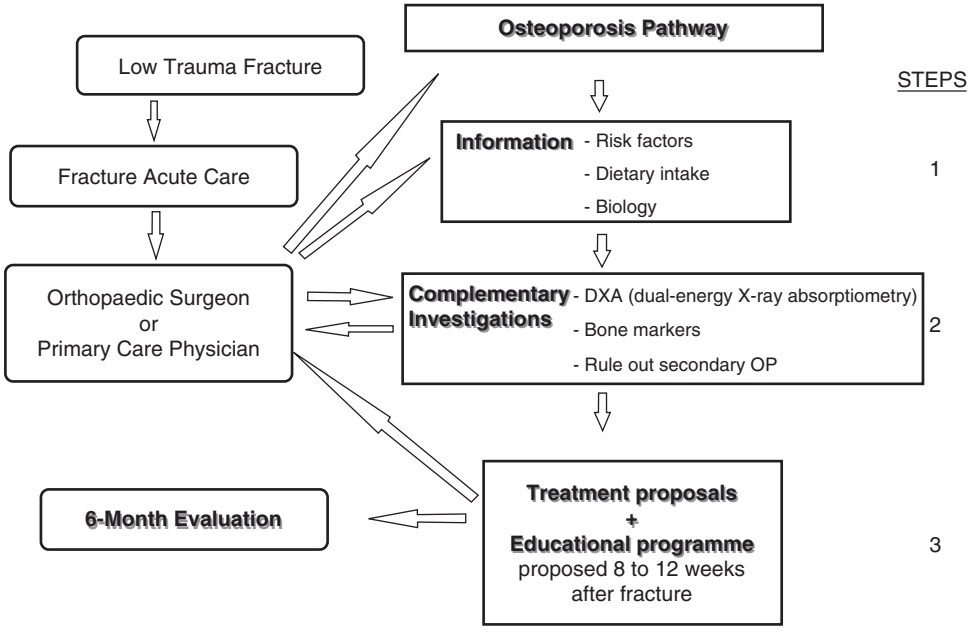


Figure 3. *Osteoporosis clinical pathway[86] reproduced with kind permission from Springer Science and Business Media*

practitioners on suitable interventions. The programme has been found to improve awareness of fragility fractures, rate of post-fracture follow-up and management of fractures[87].

Conclusion

Hip fracture is a common problem that creates a huge morbidity, mortality and economic burden worldwide. To reduce this burden, it is not only important to reduce risk of a first fracture but also to appropriately manage patients to reduce the prolonged impact on quality of life and mortality associated with hip fracture, and also to prevent the occurrence of further fractures.

Very few studies conducted to investigate the anti-fracture effects of pharmacological interventions have assessed the subset of patients that experienced a hip fracture, and there is a critical need for additional research to better define the optimal treatment for prevention and treatment of hip fractures. Only one study has assessed treatment efficacy in patients post-hip fracture. The results indicate that treatment with zoledronic acid after a hip fracture is associated with reduced rates of new clinical fractures and death from all causes.

Appropriate management of hip fracture patients should involve a multidisciplinary team that can provide seamless care from the place of injury, before and after surgery and throughout the rehabilitation process in order to optimize patient outcomes. Along with 800 IU of vitamin D and calcium, adequate nutrition and exercise are vital, and prompt antiosteoporosis treatment after surgery may also be beneficial for improving outcome. Exercise should be regular, progressive and long term (15 weeks to 9 months), and include low impact components that improve balance and strength. Prevention of further fractures can be assisted by establishing clinical pathways to co-ordinate multidisciplinary teams to identify and treat high-risk patients.

It must be emphasized that although hip fracture is associated with poor outcomes, it is possible with appropriate management to ensure optimal recovery and survival, and this should be prioritized after a hip fracture to avoid deterioration of patient health.

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